

## Answers to Chapter 4 Self-Assessment Questions

(Student textbook pages 258-9)

1. d

2. b

3. e

4. e

5. b

6. d

7. b

8. a

9. b

10. e

11. CaKr: Krypton is a noble gas and does not form ions.

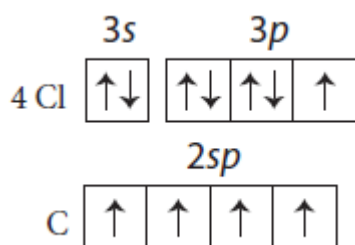
BaCl<sub>3</sub>: Barium is a Group 2 metal which only forms ions with the charge of 2+. It would not combine with three chloride ions.

NF<sub>5</sub> will not form since *d* orbitals must be available to accommodate 5 F atoms. There are no *d* orbitals at the 2nd energy level. The closest *d* orbitals are in the 3rd energy level.

12. a. Ionic bonds: Compounds with ionic bonds form ions when they dissolve in water and therefore conduct electric current.

b. Table salt is a white solid at room temperature. It dissolves in water and can conduct electricity.

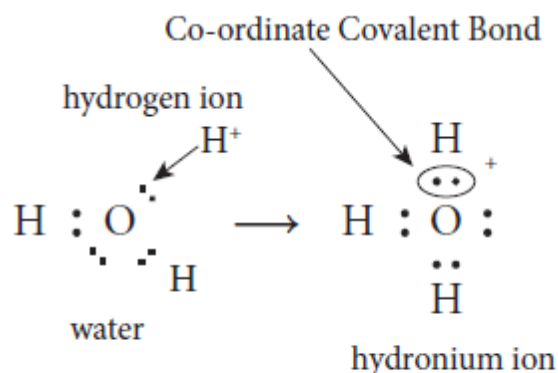
13. CCl<sub>4</sub>: The unpaired electron in each of four chlorine atoms would be shared with each of the unpaired *sp*<sup>3</sup> electrons in the carbon atom.



14. a. CaO  
b. KCl  
c. RbCl

15. a.  $\Delta EN = 1.8$ , therefore ionic  
b.  $\Delta EN = 3.1$ , therefore ionic  
c.  $\Delta EN = 1.0$ , therefore polar covalent  
d.  $\Delta EN = 0.0$ , therefore covalent

16. Both of the electrons in a co-ordinate bond are donated by only one of the atoms. For example, when a hydrogen ion combines with a water molecule to form a hydronium ion, the new bond is a co-ordinate bond because both electrons came from the oxygen atom.



17. Compounds a, b, c, and e would be expected to dissolve in water because they are all polar molecular shapes (single polar covalent bond, trigonal pyramid, asymmetrical tetrahedron, bent, respectively); d is a trigonal plane and is non-polar.

18.  $Na_2O$ ,  $MgO$ ,  $Al_2O_3$ ,  $(SiO_2)_n$ ,  $P_4O_{10}$ ,  $P_4O_6$ ,  $SO_3$ ,  $SO_2$ ,  $Cl_2O_7$ ,  $Cl_2O$ :  
Other compounds exist but these are the most important.

$Na_2O$ ,  $MgO$ ,  $Al_2O_3$  are ionic

$P_4O_{10}$ ,  $P_4O_6$ ,  $SO_3$ ,  $SO_2$ ,  $Cl_2O_7$ ,  $Cl_2O$  are molecular compounds

$(SiO_2)_n$  Silicon dioxide is a network solid.

19. Electronegativity is a measure of how strongly an atom attracts electrons in a chemical bond. Electron density describes the relative amount of electrons per unit of volume in an atom or in a bond. Bond

dipole refers to the development of a partial positive end and a partial negative end in a covalent bond.

**20.** Because the electronegativity of chlorine is much higher than that of hydrogen, the electron density in the bond shifts toward the chlorine atom to form a bond dipole.

**21. a.** trigonal pyramidal

**b.** trigonal planar

**c.** linear

**d.** square bipyramidal

**22.** Compounds a, b, and d are polar.

**23.** The only intermolecular forces acting among the molecules of each of the two compounds are dispersion forces.  $C_2H_4$  is a very small molecule with few electrons. Therefore, it would experience only very small dispersion forces.  $C_{20}H_{40}$ , on the other hand, is very large and has a large surface area. Dispersion forces could be acting at many points on the molecule at once so it experiences stronger dispersion forces.

**24. a.** Two different salts such as  $NaCl$  and  $AgNO_3$  were probably combined at  $t = 0$ . With time, one new salt, such as  $AgCl$ , was insoluble and precipitated out of the solution. The other salt ( $NaNO_3$ ) was still soluble and remained in the clear solution.

**b.** The two clear colourless liquids that were mixed at  $t = 0$  were probably a polar liquid, such as water, and a non-polar liquid, such as hexane. The two liquids cannot mix and therefore remain separate.

**25.** Answers should include cutting with other diamonds and cutting with lasers.